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W. H. Hammond

MAINTENANCE OF RAILWAYS.

EVOLUTIONS OF LABOR — EMPLOYER VERSUS EMPLOYEE : THEIR
RELATIONS — PRESENT METHOD OF OPERATING RAILWAYS
BASED ON THE RECIPROCAL INTEREST OF LABOR : ITS
CONTINUANCE DEPENDENT THEREON — HOW
RAILROADS MAY BE OPERATED WITHOUT
THE INTERVENTION OF EMPLOYEES
IF LABOR TROUBLES RENDER
NECESSARY—
FIXED VERSUS TRAFFIC EXPENSES—WHAT IT COSTS TO PRESERVE
A PROPERTY SEPARATE FROM COST OF CON-
DUCTING ITS TRAFFIC.

— BY —

MARSHALL M. KIRKMAN.

1886

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MAINTENANCE OF RAILWAYS.

The impossibilities of to-day become the common-place realities of to-morrow. It is the unexpected that happens. That about which no one dreams, for which no one is prepared, which does not seem to come within the compass of common thought, is what actually occurs. The happening of something unforeseen, the occurrence of a seeming impossibility, finds apt illustration to-day in the vast associations and purposes of the laboring classes; in the banding together of enormous numbers of men scattered over vast expanses of territory, and involving in their secret acts and intentions purposes of the greatest importance to the peace and material prosperity of every condition and class of society. These bodies, associated together and acting as a unit, present phenomena never before seen on a scale so vast, or involving interests so pretentious. To the extent that these are able to secure the permanent betterment of labor, and in so far as they are in harmony with the good of mankind, every class will be benefited, according to the maxim in philosophy that a unit in the social structure cannot receive good without the whole participating therein. Anything, it may be said, that promotes the interest of the laborer, cannot fail to be of advantage to the capitalist, because the interests of the two are co-existent.

The great enterprises characteristic of our time require the co-operative assistance of innumerable intelligent and willing hands, and in the greater ratio that these qualities are evinced, the higher and more perfect the result. But labor

cannot secure any permanent advantage not warranted by its value or the necessity that exists for its product, any more than capital can force a return out of proportion to the demand that exists for its use. Labor cannot coerce capital, no matter how perfect its organization or how wide-spread its appliances and intelligence, beyond the point of reciprocal interest. Labor, to exist at all, must act in harmony with the employer, and in due subordination to the interests of society as a whole. It must respond quickly and intelligently to the necessities of its environment, just as capital must, in its turn, occupy the avenues of trade open to its profitable employment if it would not see them diverted or destroyed. The world owes its civilization to the ability of capital to employ itself wherever possible profit may be gained, coupled with the uncontrolled choice exercised by men of working where and when and for what compensation they please; to the liberty exercised by these great factors.

It is no exaggeration to say that the compensation of labor is ever in proportion to the income derived from its service. If the margin is small in one instance, it will be found so in the other. If the gain is excessive, the reward of labor will quickly adjust itself thereto, or the law of supply and demand will assert itself to lessen the profit, thus multiplying production and relieving the hardships of consumers compelled to purchase under restricted conditions. The strife of capital to find profitable use gives multiplied employment to labor and at the same time reduces the cost of the thing produced, thereby benefiting mankind, first, by giving employment to those who need it, and second, by enabling them to live cheaply and well afterwards. The effort of labor to put up wages without due reference to the value of the product and the de-

mand that exists for it, cannot but result disastrously; first, in decreasing production, and second, in diminishing the market. Capital will ever quickly respond to any natural scarcity or demand for labor, but becomes moribund under any attempt to coerce it through the operation of force, whether exercised by labor associations, armies, mobs, or in any other direction. The condition of the laborer, and of the employer as well, has steadily and rapidly improved under the benign influences that have existed between the two based on peaceful and co-operative effort. These conditions will not be improved by artificial associations of labor seeking (through combinations or otherwise) to coerce its natural ally. The same may be said of capital in its relation to labor. The elemental forces of labor and capital, in order to exist and prosper, must go hand in hand, each responding to the demand that exists for its use, satisfied with such just and reasonable compensation as the equities of the case warrant. The conditions of the industrial world are nowhere alike, and the necessity for man's work can nowhere be made dependent upon schedules or mathematical formulas. The laborer must be able to respond to the urgency that exists for his labor, and his advancement in the world depends upon his disposition and ability to do this; upon his ability to give free expression to his ambition, strength and intelligence. If the brains and physique of men were uniform, the hours of work might be made so. But this uniformity would not, even under such circumstances, extend to different classes of labor. In some instances six hours of work exhausts, in others sixteen are possible. The number of hours should ever be dependent upon the ability and disposition of the worker, and upon the necessity that exists for his labor. The world owes its advancement to the individual effort and ambition of men. These

must not be clogged, nor restricted. To put a brake upon either is to retard the growth and diminish the comforts and happiness of mankind. No general law, or method of administration, or association of men, (whether capitalists or laborers) acting under arbitrary rules, in disregard of the varied conditions that govern the world's growth, can prove otherwise than injurious to the community generally, and in the end to those who precipitate them. The association of vast bodies of men under arbitrary leaders breeds everywhere well founded apprehension that the just equilibrium that should exist between labor and capital will be destroyed. The ability to precipitate strikes over extended territories and involving thousands of laborers, is not a power that can be safely entrusted to any man, and above all to men unaccustomed to its exercise. It is not a discretion that capital entrusts to its agents. The inevitable outcome of a struggle thus precipitated must be either the breaking up of the organizations that prevent the free exercise of man's prerogative to work where and when he pleases, or, the overthrow of society. Civilization is the product of the harmony that has existed between capital and labor, of the freedom of man to do as he pleases so long as he does not molest his neighbor. The moment that either labor or capital dominates from that eventful moment the downfall of both begins. In our great Republic liberty is so unbridled that it has given birth to innumerable heresies, to many abuses, to the studied effort of men to over-reach each other through combinations and otherwise. The attempt to combine the labor element of the country under one man illustrates this. Such an effort means the subversion of the rights of all not sufficiently powerful to resist its concerted onslaught. It says to the whole world, "You

must be governed by us, or we will no longer work for you, or allow others to work for you. You must permit us to fix the conditions of your business, or we will destroy you." From whence arises this spirit? Is it the result of too much liberty, or is it the product of oppression? Was its primary purpose an effort to rob capital of its legitimate prerogative, or was it laudable and proper? Has it grown out of abuses that ought to have been remedied, or is it a struggle for supremacy merely? Did it have its origin in the brains and hearts of honest (however mistaken) men, in some real or imaginary grievance, or did it originate in the purpose of demagogues, and in the hopes of knaves? Whatever may have been its cause, however just may have been its complaint, however right its purpose, however beneficent its intentions, the betterment of labor is not to be attained through the methods it has adopted of terrorizing over those who do not accept its dogmas. To succeed it must operate in harmony with the commercial instincts and individual freedom of mankind, otherwise greater harm than good will result from its efforts.

In this connection it is well to remember that a remedy for the evils that attend unwise and irresponsible labor upheavals or other social disorders, is not to be found in the guise of Imperial or Autocratic government any more than the encroachments of capital are to be remedied by Communism. The cure lies in the enactment of better laws and the enforcement of them afterwards; in raising the standard of our lawmakers; in eliminating from the electoral class irresponsible and unfit persons; *in wisely restricting the suffrage in fact*. Herein lies the secret of Representative government, the only form of government it may be truly said, under which capital and labor are respected and secure.

The movements of great bodies of men are ever attended with interest. The purposes of labor acting through organizations and guilds are ever a matter of concern to the community. Their power, if wisely exercised, is not fraught with harm to any one. If shortsighted or selfish, it is pregnant with disaster. Society is too strong however, to be affected more than momentarily by their ebullitions. The strength of organized (or disorganized) labor has in no way evinced itself with more startling vividness than in its demands upon railroads and in its ability to close these great avenues of business when its exactions are not complied with. The situation of railroads, in this respect at least, is no longer speculative. We have seen the two forces arrayed against each other, and it is not unlikely that we shall see it again. Heretofore the closing of a railroad has seemed so improbable as not to come within the domain of thought, and yet, through the fulminations of one man, this seeming improbable, impossible thing occurred. The history of the troubles in Missouri makes it apparent that in the upheavals of labor great railroads may at any time be paralyzed as other manufactures are, for the want of some one to operate them. What does this portend? That the railroads are to be disbanded, or that those who seek to coerce them will be frustrated? The employment of large bodies of men is based on the individual liberty of the laborer; on the confidence that capital feels in his good intentions; on the disposition of the latter to work where and when he pleases for such wages as his employment justifies. Both the work and the rate paid are ever dependent upon the law of supply and demand. It is impossible that capital should exist upon any other basis.

It is not impossible that the vast combination of labor that

we have noticed, and the unwise exactions that it suggests if it does not invite (in consequence of its seeming irresistible strength), may render it necessary to disband the enormous bodies of men that have been employed by railway companies and other great manufacturers. Nothing can be more certain than that the operation of these enterprises cannot be carried on by operatives whose loyalty to the employer is to be stinted, or whose freedom is subject to the interference or arbitrary will of others. No man can serve intelligently or honestly two masters. When it becomes apparent to employers that they can no longer place faith in the loyalty of those in their service they will abandon the enterprises in which they are engaged whenever they cannot be carried forward without the aid of employes. When men can no longer contract for labor and have such contracts observed without reference to extraneous influences, they will cease to be employers. Nothing can be more certain than this. This exceedingly interesting and instructive fact clothes the labor troubles that we have noticed, and the possible contingencies that they foreshadow, with a new interest. This is especially true in regard to railroads. If men cannot be found to operate these properties who will serve their employer loyally, the question naturally suggests itself, what possible substitute is there for these disaffected servants? Is it possible to carry on the business of railroads without their assistance? As a matter of fact, there is no more reason why the owners of railroads should operate their property directly through the medium of employes, than that the Government should operate omnibuses and hacks. Man is an adaptable animal, and quickly adjusts himself to his environment. And when it becomes apparent that the loyal and trustworthy

force necessary to operate railroads cannot be secured, a substitute will be found therefor. Owners will everywhere ask themselves this question : Must we sacrifice our property, or can we manage it without the aid of employes ? The answer to this question will be that the operation of their property is not dependent upon their employing the force necessary to carry it on. The proposition seems startling, but it is not more so than the organization and growth of the associations and leagues that, in some cases, to-day seek to deprive railroad owners of the right to manage their property through the medium of the men they hire and pay.

The means by which owners of railroads may manage their property without employes, or with at most only a few, are both easy and numerous. That, however, which presents itself to us as being most feasible is by subletting their business ; the renting of their track and facilities to others. It is undoubtedly true that there is no more reason why a railway company should run trains than there is for the state to run canal or steamboats. Quite the contrary. There can be no doubt but that the transportation business is carried on more effectively and economically upon our rivers and canals by individual enterprise than it could possibly be by the state. The latter in such case wisely confines its efforts to the promulgation of necessary rules and regulations, and the very simple duty of keeping the property in repair. Why may not railway companies equally restrict their efforts ? Why may they not confine themselves to the simple duty of maintaining the property and governing the traffic passing over it ? If from any cause it is sought to filch the management of railroads from their owners, why may not the proprietor say to the community, "there are my tracks, sidings, warehouses, docks, tele-

graph lines, round-houses, shops, water stations, fuel sheds and other paraphernalia: take and operate them, paying me such reasonable rate therefor as may be right and proper." How quickly under such a condition of things would individual carriers and diminutive companies formed to operate trains, furnish supplies, repair machinery, and handle business spring into existence. All these varied industries are to be found in perfection along the lines of our canals and rivers, and are all the more economical and effective because operated by private enterprise. Under the conditions mentioned, men of moderate means would find no difficulty in engaging personally in some particular branch of the transportation service. Each individual would pursue his particular venture unrestricted, with the sole view of deriving the greatest advantage possible to himself therefrom. With practical acquaintance he would find it both possible and profitable to utilize his family and relatives in the conduct of his business, and it would be no unusual thing, I imagine, to see a train conducted like our lighters, by the members of a particular family; the father acting as engineer, the mother performing another service, and the children still others. In this way individual carriers would always be able to command the labor necessary to conduct their business with despatch, at a reasonable rate, and with such intelligence, continuity and loyalty as the case required. Under such conditions the more intelligent and enterprising employes of railroads would become active purveyors, while the dissatisfied and worthless, or those disposed to depend upon the efforts of others rather than upon themselves, would drift off into other and simpler employments. Men would own, or operate as lessees, warehouses, machine shops, trains, fuel and water stations, just as men

operate express wagons, hacks, gurneys, trucks, livery stables and machine and blacksmith shops in our towns, or run boats on our canals. These changes would require very little labor or preparation, and would involve very little confusion or expense. They would not come instantaneously, or affect the whole service at once. Railway companies would first sublet that portion of their property which seemed most easy and practicable, and as the necessity for their retiring from the labor market became more and more noticeable, or its advantages more apparent (as they assuredly would), this process of subletting would go on, until eventually it extended to the property as a whole, save perhaps its maintenance. Even the latter, there can be no doubt, might be carried on under the contract system more cheaply and effectively than by the company directly. The owners of railroads under the conditions named would neither know nor care who used their property, so long as the necessary regulations were observed and the tolls duly paid. The nature of the traffic would no more interest them than the business men of our streets are concerned in the traffic of the teamsters who pass to and fro. Tolls would then be based on the value of the property leased, or upon its use as now. The profit derived by the lessee would be dependent upon his zeal and intelligence.

The possibility of railroads being operated under such conditions as the foregoing may strike the reader at first sight as impossible. As a matter of fact, however, it would be very simple. We see things quite as startling occurring about us every day. We are peculiarly the creatures of experiment; of adaptations to means, of means to ends. Our form of government is an experiment. It is based on theory. Its methods and conduct were at first wholly experimental; and while

these experiments have proven, in many cases, creditable to the discernment, intelligence and honesty of those who suggested them, yet in many other cases they have proven directly the opposite. Certain it is that the concentration of capital in great properties, and the aggregations of enormous bodies of men as the employes of corporations, can no longer be carried on under forms designed for merely primitive conditions or under conditions that make these great enterprises the creatures of those who operate them. The operation of railroads and manufactories by their owners, it is apparent, is only possible as long as the force engaged in carrying them on acts in harmony with the proprietor; with the single object of achieving success. The moment that the owner and the laborer are no longer free agents to carry out as individuals in harmonious accord the purpose that seems best to them, that moment labor will cease to find employment or capital recompense. Capital will not seek investment where profits are dependent upon a thing so uncertain as the caprice of men acting as a unit or without immediate and special reference to its rights and necessities. The public, moreover, will no longer regard the rights of labor thus governed; the latter will be compelled to give way to conditions more in harmony with the good of society as a whole. The solution of the problem, in the case of all railroads, it is possible, may be found in delegating their duties; in subletting their management; in leasing them to small proprietors instead of attempting to operate them as a whole. Those who look to the government as the source of all good may ask why, if the railroad companies can no longer operate their own properties, they should not be turned over to the government? But would such a course lessen the evils that render the management of them by

their owners impracticable or unprofitable? Not in the least. The evil would be magnified under government ownership, not lessened. The government owes its strength to its individual members, and if these, acting singly or in concert, will not allow the owners of railroads to manage their own, it is not probable that the government would be more successful. The latter, to be sure, possesses means of protecting itself that the railway companies do not, but as the disturbing element forms a part of the government, and is moreover an integral part of the railway system as well, it is not likely that the control would be either effective or wise.

None of the conditions that I have outlined may become necessary, may indeed transpire; but there can be no difference of opinion among intelligent men in regard to this proposition, viz.: that the laboring classes are even more interested than capital in the protection of the latter in all necessary and proper ways, and extending to it every assurance that it shall be permitted to manage its own without intervention.

A railway strike invites curious reflections. On one hand we see the community pressing in every direction for lower rates, for better accommodation. On the other hand, the employe claiming higher wages and less work, the granting of which will increase rates and lessen facilities. The two things are not consistent or in harmony with each other. Low rates, it is manifest, mean moderate wages, as few employes as possible, cheap material, efficient service. The reverse means high rates, or the bankruptcy of the corporation. It must not be forgotten, in considering the railway problem, that the cost of operating is paid by the community. The owners furnish the property. The community pays for operating it, including interest on the investment. Anything that increases

the cost of working—any destruction of property—any diversion of business—must be made good by the farmers, stock-raisers, miners, merchants and traveling public.

The situation of railway employes, in order to secure the highest results, should be secure and their wages reasonable and such as the equities of the service warrant. This has been the basis of adjustment heretofore. To increase wages beyond this point, is to curtail the usefulness of the property by impoverishing it, or to increase the rate charged beyond the capacity of the consumer to endure. There is no escape from this dilemma. Abnormal or forced levies upon railroad companies or other manufacturers must be met by enforced levies in a contrary direction, and when the wages paid, or the income derived from a property, is interfered with, it is no longer governed by natural laws; that moment there is introduced into its operation special conditions that can only be met by the exercise of special powers. In view of these facts, it is well that the public, when sympathizing with and aiding employes in enforcing demands for higher wages or fewer hours of labor, should remember that compliance involves a corresponding increase in the price of the thing produced, and that this increase must be borne by individual citizens to the extent they severally use such product, or the product of those who use it.

In considering the difficulties of the subject, real or prospective, we have not, up to this point, seriously considered the question of the *cessation* of railway business in consequence of labor complications. The idea that a railway may cease operations has no more occurred to us than the thought that the Mississippi may cease to flow. But it is apparent that the power exercised by labor, if unwisely directed, not only ren-

ders the stoppage of railroad properties possible, but probable.

Under normal conditions the stoppage of a railroad would, of course, be impossible. Under all proper conditions the community would not tolerate such a state of affairs. But under the conditions we have actually witnessed, the community may be quite as powerless as the carrier to prevent it. Under such a state of affairs, it is possible that the community, quite as much as the railroads, may recognize the necessity of closing the railroads temporarily, just as we close a warehouse or manufactory when it is no longer practicable to operate it. It is possible that in this way, and in this way alone, the diseases that afflict our corporate life, and that seem to be growing evils, may be cured. The remedy is heroic, to be sure, but the conditions may require an heroic remedy. Up to this time, the only contingency that has ever prevented the operation of railroads has been the contingency of war. But through the developments of a day that which was thought to be impossible occurred. We have seen a great property, traversing four or five thousand miles of country, stopped at the command of its employes. This stoppage was followed by acts of violence and by the destruction of much of the property of the afflicted company. The striking employes, moreover, did not claim that they had suffered any unkindness; they were merely avenging an insult offered to a brother employe engaged elsewhere. If men will act thus hastily, will thus unitedly offer themselves as a vicarious sacrifice, to what lengths may they not go in response to a real grievance? It is possible that with more perfect development the labor unions may be able to exercise power with moderation and wisdom; but this has not been the experience up to this time. Organized, generally, for benevolent purpo-

ses, they have ended by making the coercion of capital one of the cardinal tenets of their faith. The power they possess by which they may easily and quickly compass the ruin of those who oppose them by blocking operations, has made them arbitrary and autocratic. The exercise of this power will eventually prove their destruction, or the destruction of the commerce of the country.

The prosperity of the world evinces the wisdom and moderation of capital. Based upon individual freedom, its perpetuation is only possible under such conditions, and labor must ever consent to treat with it individually upon the merits of each case. It cannot throttle it as it would an unruly ox, but must seek its ends by fair representations. I do not wish to be understood as saying that labor may not have had cause of complaint. But the fact of labor having suffered injustice does not make unjust action on its part defensible. Absolute justice is an impossibility. The evils of which labor complains, and which it seeks by physical force (by preponderance of numbers merely) to remedy, will correct themselves without the aid of such forces, and when so corrected will prove both lasting and beneficial.

The times in which we live are out of joint ! Out of harmony with the practices that have governed the world from time immemorial ; our governments are based upon numbers ; our condition upon numerical majorities ; the equities of cases are no longer considered. This is so in political matters ; it is so in commercial affairs. Vast numbers of laborers not only exercise the right of not working, but they claim the right to exercise the power to compel others to cease work. Thus the whole structure is threatened. Similar conditions at an earlier age, when industries were isolated and required only the em-

ployment of a limited number of men, involved no general or prolonged hardship; but with the vast concentration of capital and labor that we have at the present time, this spirit of dissatisfaction and lawlessness threatens the overthrow of the prosperity of the country. In the case of railroads, its effect is to demoralize the operating force. This foretells accidents, delays, inadequate facilities, irregular service, higher rates, incompetency, neglect, general bankruptcy. How shall it be stayed? It is probable the united intelligence, honesty and patriotism of the laborers themselves will correct the evil, but if this should not be the case, then the railway companies must adjust themselves to the new condition of affairs. This they may do by the rental of their property, as we have suggested, or by ceasing to operate it until under new and happier auspices business may be resumed under more favorable conditions.

The temporary closing of our railroads would not be an altogether unmixed evil. The silence that would follow such an event throughout the commercial and social world would be conducive to much calm reflection; to a wider appreciation, possibly, of the relation of cause and effect. The struggle would be a merely passive one, and therefore all the more beneficial in its tendencies. The act of the employer would be merely negative. It would not generate new hatreds, nor intensify those already existing. No one's liberty would be threatened by it. It would be an instructive sequence in the history of a period that had for its basis the growth of sentiments that involved the destruction of the right of property and the freedom of individuals. Under the mollifying influences of this cessation of business, it is possible the employer would acquire added wisdom. While surveying his un-

employed property he would be certain to remember and appreciate the mistakes, if any, he had made in the organization and government of those under him. If he had neglected to make their interests his own, we may be certain that the termination of the conflict would not find him ignorant of the fact. The employe on his side would find it extremely difficult to subsist without earnings, however he might punish his employer; he would learn how trifling our present afflictions are sometimes compared to those that follow in the wake of inconsiderate action. The community, on its part would receive a valuable and needed lesson. It would learn that railway property is an integral interest in harmony with other interests and making up a part of the prosperity of the land; that the servants of railroads are but the creatures of the people and a part of the social and commercial system; that encouragement to them to separate their interests from the interest of their employer, or the making of undue exactions, reacts directly and properly upon the community. Thus through its losses and embarrassments, it would learn needed wisdom. Railroad owners would learn to enquire more earnestly and intelligently in regard to their employes whenever they had been remiss in this respect. Employes would learn how much wiser it is to suffer a little than to lose all. The people who are so quick to criticise and to carp at railways and their methods and the honesty of those who own and operate them, would have abundant leisure to study their own shortcomings and disposition to over-reach their neighbors. Thus out of the enforced idleness much good would accrue to all concerned. It is possible that such a condition of affairs may never occur. Every patriotic person must hope that it will not. It pre-supposes an abnormal state of affairs, a species

of nightmare; a derangement of the circulation; a sleep in which the vision is distorted, wherein we have dreams, in which we see many strange and hideous things.

In considering the possibility of these dreams becoming real events the question occurs what do our great labor organizations portend? Is their development and sequence to be progressive in its violence or peaceful? Are they the outgrowth of social debauchery, political demagogism, or have they their origin in some serious and potent evil inherent in our business methods? If the latter, is it a thing of the past, or does it exist to-day? If a commercial evil, in what did it originate and who is benefited by it? Is it in process of extinction or of development? If in the latter, how is it to be remedied? These enquiries and others suggest themselves even in the limited and superficial glance at the subject which we are constrained to give it in this preface to certain investigations into the mechanical operation of railroads, albeit these investigations are mainly suggested by the peculiar conditions noticed. The possibility that a railway company may find it necessary to close its property, suggests the conditions that would attend such an act. *Can the owners of railroads permit their property to lie idle? The pussiceness of capital is one of its greatest elements of strength; herein lies the secret of its power, its ability to perpetuate itself; its growth and beneficent influence. When it no longer possesses this power it can no longer exist. Does it possess this power to-day in railway property? Undoubtedly.*

What would be the effect of idleness upon railroad property?

Wherein would it deteriorate?

What would be the amount of this deterioration?

What expense does the simple maintenance of railway property engender?

Would it be wiser for owners to suffer a present and known loss in an effort to maintain their right to manage their property, or would it be wiser for them to effect a settlement with discontented employes, no matter at what sacrifice of their dignity and rights?

It is upon such questions that the contingency of a railway company closing absolutely its affairs for six months, or a year, or two years, may hinge, and upon the wisdom that governs those making the decision the whole future of mankind may hinge.

Let us suppose that a railway company decides, in view of the possible fact that it can no longer operate its property in harmony with honest usage or good government, that it will close its affairs until such time as its just and necessary rights are accorded it, what would be the expenses attending the maintenance of a property under such conditions?

The question as to the mere cost of keeping up the property of a railroad, and the circumstances attending its closing, is in itself an interesting one. It is of special interest to railway men. It is interesting abstractly considered, but is especially interesting in its relation to the cost of maintenance and operating under *normal* conditions. It is a subject that invites investigation at the hands of experts in such matters; a subject that would seem to have suggested the most careful enquiry, the most minute research. Yet I do not remember to have ever seen any attempt to estimate this cost, or to have seen it discussed.

Aside from the possibility that a railway may find it necessary to close its property on account of the impossibility

of finding men to operate it, other circumstances may intervene to bring about such a result. Such obstructions to be sure, do not seem probable. Neither did it seem probable that a railway system extending over several states would be paralyzed by the simultaneous uprising of its employes. Yet such an event occurred. The circumstances of this occurrence, moreover, were such as to suggest the probability that a similar cessation might happen at any moment upon any particular road or upon the roads as a whole. In such an event the operation of these properties would manifestly be an impossibility. There would then be no other course left but to close. It is possible that such action would be the only course that could reach or cure the evil. I do not say that this is likely to happen, but it is clearly possible, I might almost say probable. Where labor has the right and facility to organize and act in concert over a great empire without reference to the rights of others, and is encouraged by the political institutions of a country to do so, everything is possible. It is no more improbable that bands of laborers will cease work or attempt to prevent others from working under such circumstances, than that enormous bodies of men should be found to carry on wars and conquests from which they derive nothing but death or despair. The nineteenth century is an age of centralization in everything save politics. It is especially so in business. We observe it in the growth of corporations and manufactories and other great enterprises. It is this vast concentration of capital, possibly, that suggested the centralization of labor; the delegating to attorneys under various disguises, of the right to control arbitrarily the actions of the many. But, the organization of labor, it is to be observed, is much more extensive than the as-

sociation of capital. The latter is restricted and isolated in its efforts. Labor seeks to group great masses of men employed in widely diversified industries, and extending over enormous areas of country, and in this way to exercise an influence out of all proportion to the individual importance of particular trades. If this effort is successful, and the vast association of men thus formed is not wisely controlled and governed, it will involve corresponding centralization of capital; certainly it will render the continuance of business under present conditions impossible. Not only will the railway system be paralyzed, but all the industrial interests of the country will, temporarily at least, collapse. Let us hope that so direful a contingency will not occur. But it is not only possible but probable so long as men will precipitate conditions that render it impossible for others to forecast events, or control that which lawfully belongs to them.

How long the suspension upon our railroads would last under the contingency named would depend on the disposition and power of the people as a whole to re-assert the just and necessary prerogative of law, viz.: the security of property and the protection of individuals in their right to work. But the calamities that would grow out of such an upheaval would require many years, perhaps generations, to heal.

In the event of the suspension of railway operations, let us see what would be the effect upon railway properties. What would be the minimum amount that it would be necessary for railway companies to expend in such a state of affairs in order to preserve their properties from deterioration from natural causes? Having no income whatever, it is manifest that the necessary cost of maintenance would have to come from assessments levied upon the proprietors, unless a reserve fund

sufficient to meet such outlay has been laid aside in advance. Of the necessity and wisdom of every company possessing such a fund, viewed from this standpoint, no one can doubt. The extent of this fund would, it is manifest, be dependent upon the nature and extent of the property. Such a fund need not be unproductive. If judiciously placed it would be a source of income as well as strength to its possessor. Its effect, moreover, would be quickly evinced in the price of the securities of the company interested. It would afford a guarantee against the contingencies of business disturbance either through open or covert war. It would enable its possessor to meet necessary expenditures under every contingency, thereby rendering him master instead of creature. With such a fund taxes could be paid, sinking funds met, interest on mortgages satisfied, and the necessary expenses incident to the maintenance of a property provided for as they accrued.

It may be assumed, I think, that in the event a company found it necessary to suspend operations, its bondholders would voluntarily defer interest payments for a reasonable length of time; nevertheless the contingent fund should provide a reasonable sum to meet interest as it accrues rather than subject the company to possible embarrassment from unreasonable or irate bondholders. The amount of a Contingent Fund will be dependent upon the annual burden for interest, tolls, sinking fund, and current expense of maintenance. The expenditures for the last named purpose are imperative and must be met as they accrue in order that the owner may not suffer enormous usury, subsequently, from neglect to preserve his property from disintegration. What sum would this require? Would it be so great as to render the proprietor unable to meet it under the circumstances mentioned? I think not.

We have no exact data as to the cost of maintenance and it is not procurable, but the amount may, I think, be determined with approximate accuracy.

Stripped of the glamour of public comment and convenience, railway property does not differ from other property used in manufacturing, except that it is scattered over a wider territory. In the case of manufacturers generally, their property lies within narrow limits, and when not in use the gates may be shut, and it thus becomes isolated, and in being isolated is rendered comparatively secure, so that, no matter how great the value, its guardianship is compassed within the care of a limited force of watchmen. This force not only serves to protect the manufacturer's property, but also prevents its deterioration, thus answering a double purpose. Unfortunately for railroad property, this simple disposition is impossible. Extending across the country, it is everywhere exposed, whether in use or otherwise. Its greatest security, even under normal conditions, lies in the difficulty of destroying or removing it. This fortuitous circumstance, renders it possible for the ordinary police force of the country to compass its protection without material or extra outlay. This freedom from risk would prove especially valuable in the event of a company being compelled to cease operations. Only that portion of its property rendered insecure by fire would require especial guardianship, and even here the risk would be slight. Moreover, in considering the protection of railway property under the abnormal conditions of riot or other violence, it is well to remember that the proprietor—being a tax-payer—the States and townships where his property lies must render him due protection, or, in the event they do not, must reimburse him for any damage he suffers. Losses, therefore, that

arise from the acts of mobs are public burdens, and may not be thrown upon the proprietors of railroads, except in so far as they are taxed with others to meet such damages. The exercise of reasonable diligence in the preservation of one's property is, however, under all circumstances, a duty; this duty railway companies are least of all likely to disregard. So that, in the event of stoppage, we may expect that they would still exercise a general and constant watchfulness over their properties. Would this require special watchmen, or would the slight force required to maintain the organization be sufficient to meet the necessities of the case? I think the latter. In determining, therefore, the extent of the force necessary to maintain a property, we also determine generally the question of its protecting force, except, perhaps, in isolated and unimportant cases.

The question of the cessation of business upon a railroad suggests many interesting enquiries, innumerable speculations. It involves many conditions manifestly not capable of demonstration in advance, contingencies that no one can predetermine. These contingencies, it is apparent, will be dependent largely upon the peculiar features of properties. Any attempt, consequently, to determine the expenses or methods incident to such a state of affairs, must make liberal allowances for differences of this nature. In attempting, therefore, to form a general estimate of the expense of maintenance, it may be assumed that it will be less or more than the amount required in particular cases, according as the situation and wants of a property render it more or less expensive than railways generally.

The cost of maintaining a property closed to business will also depend upon whether the cessation is to extend over a long or short period. If the former, the expense

will not be nearly so great in many respects as when the stoppage is for a short or indefinite period. In the event the cessation were likely to extend over a long period, it would only be necessary to look to the preservation of the physical part of the property; the traffic organization, or that portion of the force connected with or growing out of the conduct of business, would be wholly dispensed with, or so greatly reduced as to be no longer distinguishable as an organization. If, however, the stoppage were only for a short or indefinite period, it would be necessary to preserve at least the nucleus of an organization; to retain such portion of the force as would render the resumption of business practicable without great delay or expense.

Where the stoppage was likely to continue over a long period (as would be the case in the event of general labor disturbances), many expenses that, under other circumstances would be necessary, could be wholly avoided. Thus, the cost of keeping up the roadbed at a point that would permit the movement of traffic would not be required; it would not, for instance, be necessary to repair from day to day the ravages of storms or the damages caused by frost; the expenses attending the use of bridges, culverts, buildings and machinery necessary in active employment might be wholly dispensed with, as only general or cursory attention would be required to be given them. Attention would be directed to the preservation of the property from permanent injury rather than to sustain it at a high point of efficiency. Property maintained under such conditions would, it is manifest, require considerable time to be placed in shape for resuming active operations when the embargo ceased. Buildings would have to be put in order, tracks repaired, bridges and culverts looked after, and a thou-

sand things attended to before general resumption could take place. This would require a month, perhaps six months, according to the disintegration of plant and organization. It would, however, be unavoidable, as the resources of the strongest company would not warrant it in attempting to keep up its property at the maximum point of efficiency throughout a long or indefinite period of suspension.

In attempting, therefore, to determine the cost of maintaining a property (without reference to traffic), the dissimilar conditions attending a remote or immediate resumption of business must be considered. If resumption is likely to be immediate or within a reasonable time, the expenses of maintenance would not be much less than during active operations; and by expense I mean simply the cost of preserving the property from deterioration. To be sure, the conditions attending the disintegration of property from natural causes must be very nearly the same, whatever the conditions of its use or non-use, but the advisability of reducing outlay would be so great that we may be sure expenditures would be cut down to the lowest possible figure, if a doubt existed as to the probable duration of the suspension.

In considering expenditures of this nature it is well not to forget in passing that they are not borne by the railway companies alone, but are shared by the community, not only in the stagnation of trade that ensues and the losses incident thereto, but in recouping the carrier afterwards either partially or wholly for the loss he has suffered in consequence of the neglect of the community to protect him. Under the conditions named a railway company will repress within the narrowest limits every expense attending the maintenance of its property. This repression will manifest itself in the dis-

charge of the force and in ceasing to purchase or use material further than may be absolutely necessary.

The *Fixed Expenses* of a railroad are:—

1st.—The cost of Maintaining an Organization.

2nd.—The cost of Preserving the Property from Disintegration and Decay arising from Natural Causes.

3rd.—Taxes.

4th.—Interest on Funded Debt.

5th.—Satisfaction of Sinking Funds.

6th.—The fulfillment of Leases, Contracts and Agreements.

As already stated, little effort seems to have been made heretofore to determine the amount of these expenses, or more particularly, perhaps, those relating to organization and maintenance of property. Few things are less understood. Every expense being directly and primarily due to traffic, no attempt has been made to effect a separation. The conduct of business affords the incentive and purpose of railway construction, and the whole cost of operating these properties is therefore chargeable to business; is a tax upon it which it cannot and should not escape. The rate charged in every case is intended to take cognizance of the expense entailed in working the property as a whole, just as in the operations of a hotel the price that is asked for accommodation is not based on the cost of the table, or the service, but involves the whole outlay. The basis of railway income, aside from a return on the first cost, rests on the total expenditures of the property, including the force employed, whether engaged directly in the traffic of the line, or in its maintenance. In attempting, therefore, to deter-

mine the fixed expenses I do not wish to be understood as intimating that such expenditures are, in any way, distinct from traffic, or that traffic is not under obligation to bear the burden of these expenses.

Any attempt to separate the fixed from the traffic expenses must be partly speculative. It must be based almost wholly on collateral data, and the estimates of experts. Now, while such enquiries must be largely hypothetical, it is possible they may possess great practical value to those who own and operate railways.

The possession of such knowledge will, at least, enable them to contemplate the operations of these properties from a higher standpoint, and it is possible—indeed, I think quite probable—will prove valuable in directing enquiry into collateral subjects of direct and pressing importance.

The acquisition of knowledge, as everyone has occasion to remark, is not of so much value for the specific thing that we learn as for its contingent revelations, the correlative ideas that it suggests, and so it may be possible that even an imperfect conception of the fixed expenses of a railroad may afford suggestion to those who are not disposed to regard the information itself of especial value. Thus while we may not care what relation the fixed expenses bear to contingent outlay *as a whole*, if we knew accurately the effect of wear and tear of traffic upon particular classes of expense and the percentage of deterioration from natural causes, there can be no doubt that the knowledge would prove of value to particular men if not to railway men as a whole. The truth of this finds apt illustration in the case of track rails.

Practical men with whom I have communicated as to the

relative deterioration of rails from climate and traffic, have stated that a rail will remain fit for use for ever, if trains do not run over it ; others put the deterioration from natural causes at two per cent. ; others at five per cent. and so on. As a matter of fact, the deterioration of rails due to climate while not great is marked and cumulative. The deterioration from climate in the case of other material is, as a rule, much greater. It is not necessary, nor would it be proper here, to enter into a minute or scientific statement of the effect of climate upon different classes of material. The subject belongs more properly to scientists. I merely cite the case of rails to illustrate the lack of information on such subjects by those whose duties are connected wholly with the care of such property.

In many instances the natural decay of railway property is much greater than the damage from actual use. This is the case where the traffic approximates in extent the average business of our railway system. Where business is so excessive as to produce immediate deterioration, the relation that fixed charges bears to traffic expenses will be, of course, less. *But whatever a property may suffer from natural decay, that is a fixed expense.* The cost of Maintenance of Organization, as already stated, is also a fixed expense.

The cost of maintenance of organization, it is apparent, is much less, relatively, for a company doing business than for one not actively engaged, for the reason, that in the former instance the force thus occupied finds other and remunerative employment in connection with the current business of the road. Thus, the superintendent not only exercises direction over the maintenance of the property, but he also superintends the conduct of business generally. In either case he is essential, and while he must possess greater diversity of knowl-

edge in order to enable him to attend to both these duties than either, singly, requires, yet the increased expense occasioned by the multiplication of duty, is not great.

The number of skilled laborers required in the operations of railroads is much greater than is commonly supposed. These form a part of the organization. They embrace innumerable men that are not usually classed under this head. Every one understands that a locomotive engineer must be technically qualified. The value of skill and experience in the locomotive fireman is also well understood. The necessity of technical knowledge on the part of machinists is well known. But the officials, agents, clerks and foremen of railroads must possess skill of even a higher order, and must, moreover, possess practical knowledge of the geography of the property and its business and wants; that is of the greatest importance and value. This is not so well known. It is probable that no class of labor possesses greater technical knowledge and skill than the clerical force of a railroad; and by clerical force, I mean the whole body of employes concerned in the movement of traffic. They are the eye and arm of the service, and afford, moreover, much of its needed intellectual force. The affairs of a railroad are so great, and extend over so wide a range of country, that the general management can do little more than avail itself of the information that the clerical force suggests or collects for its disposition. All this force, in the event of the stoppage of business, it would be necessary to disband.

Only those who have watched the growth of a railroad, and the expense and infinite patience and skill required to build up an efficient force, can estimate the loss its disbandment would entail. But it would be unavoidable. Necessity

does not recognize either values or utility. The situation of our railroads, if through the upheavals of labor or other social disorders they were compelled to suspend business indefinitely, would be that of properties without organization or force. In attempting to determine the Fixed Expenses involved in Organization, I shall not consider the case of such railroads; they can, it is manifest, have no organization, and consequently no fixed expenses of that nature. I shall confine myself, therefore, to those properties closed for a short period only, and likely at any moment, or within a reasonable length of time, to resume operations. Whatever the expenses of such properties are, must be the Fixed Expenses of Railroads under Normal Conditions. In the case of these roads the officers and employes necessary to the conduct of the minimum traffic would require to be retained. This force would embrace the general management, heads of departments and chiefs of bureaus and their *principal* assistants or clerks. Those, in fact, possessing a knowledge of the workings of the departments and versed in the requirements of the company's affairs, and necessary to its operation. Such a force cannot be secured at will, and business cannot be discharged without it. It is the staff, and grows with the growth of a corporation, and under right conditions, should become more and more efficient every year. The necessary force of a road also embraces agents at stations, and, where business at a place is great, the immediate assistants of the agent; all those, in fact, possessing *high technical* knowledge in the discharge of station business. They likewise constitute a Fixed Charge. Common laborers, and those engaged in mechanical or simple employment about the general offices, warehouses, and other buildings do not. They may be replaced at will. The cost

of watching the property is not a Fixed Expense, as it may be performed by employes possessing technical skill who form a part of the fixed cost. If the conditions are practicable the *nucleus* of a train force should be retained. It properly constitutes a fixed charge. In the case of conductors, baggagemen and brakemen, it embraces probably 25 per cent. of the force. The skill afforded by this body will constitute the nucleus of an organization. In the same way 25 per cent. of the engineers and firemen of a company may be denominated a fixed charge. Such a train force would prove ample to guard the rolling stock and maintain it in a much higher state of efficiency than that which ordinarily characterizes it when in active employment. The engineers, being mechanics, would be able to renew the equipment and machinery as it disintegrated from natural causes, while the auxiliary force would perform the less difficult work connected with its simple protection.

Thus the technical force that is essential to a company and that may be said to grow out of the necessities of traffic, may be utilized in the maintenance of the property, thereby serving a double purpose. Employes occupied in advertising and otherwise soliciting business do not form a fixed expense. Liabilities for personal injuries, damages to property, contingent expenses, stationery, printing, supplies, advertising, oil, waste and tallow belong wholly to traffic, or if any portion is chargeable as a fixed expense it is merely nominal. As a rule the forces of a railroad that constitute a fixed expense will find active employment at all times, even if the property should be closed to business. However, it does not necessarily follow from this that there could be no reduction in the wages of this force. On the contrary, it is probable that in the case of the suspension of business by a

company, a very large reduction in current wages might be made without disturbance or ill will. The manifest necessity of such a course and its justness, could not but be apparent to all and would be cheerfully acquiesced in. The amount of this reduction would depend somewhat on individual cases, but would, I think, approximate 50 per cent. That this reduction would involve hardship to those it affected, goes without saying, but as this hardship would extend to the owners of the property as well as to employes, it would be borne cheerfully, and if the suspension were likely to be of long continuance, it is possible that the reduction might be even greater. However, fifty per cent. may, I think, be stated as the maximum sum. So that in determining the Fixed Expenses of organization we may deduct that per cent. of the wages, including salaries paid under normal conditions. In reference to the force that it would be necessary to retire, (in the event of suspension) it is probable that the great bulk of the men thus discharged would quietly await re-employment in the service from which they were dismissed. This would certainly be the case if the stoppage were not likely to be of long duration, or if the circumstances attending dismissal did not involve personal animosities. It could not but be apparent to men thus situated that their interests would be more likely to be conserved by quietly awaiting re-employment, than by seeking engagement elsewhere, accompanied as it would be by the necessity of commencing anew. It might be necessary in some cases, (as it would indeed be both politic and wise wherever possible), to allow the force thus dismissed a small sum monthly in order to prevent its disintegration. Such a course would be eminently humane, if the resources of a company permitted. I assume, of course,

in suggesting these gratuities, that harmony of relationship exists between the employer and the employee. Under all circumstances such feeling ought to exist, and will, unless destroyed by peculiar and exceptional circumstances.

It is possible, indeed probable, that the employes of railroads have grievances, but that these grievances are such as to engender hatreds, or permanent ill will or indifference to their trust, is impossible. Nor can they be so great or permanent as not to be more likely to be corrected by conciliatory means than by strikes or other violent means. In the case of railroads and other great properties the interest of the proprietor in those who operate his property is too intimate, too vital, to permit him long to disregard their welfare or refuse to remedy just causes of complaint. And above all, employes should not in enumerating their grievances forget or disregard those of the employer. No intelligent person who has observed the operation of properties carried on wholly through the medium of hired agents but must have observed innumerable instances of gross neglect on the part of such agents, of manifest inefficiency, gross wastefulness, culpable neglect, inattention to duty, idleness and other evidences of thoughtlessness or utter disregard of the interests of the owner. Every such instance is a legitimate and proper subject of complaint on the part of the proprietor, and while he may and does seek to rectify such acts whenever known to him, still his efforts in this direction, no matter how watchfully or intelligently directed, can never wholly, or even partially, correct the evil. Employes, therefore, while enumerating their grievances, should not be unmindful of the grievances of their employer. To neglect or decline to do so evinces lack of thoughtfulness, honesty of intention, or regard for the rights of others.

In the case of great corporations the interest of the owner is so impersonal, so covered up in the multiplicity of owners, in the rules and regulations of the service, in the acts of managers, and in the fulminations of legislatures, that we cannot wonder that the employe sometimes forgets that there is an owner, fails to recognize the rights and prerogatives of the employer or the duties and responsibilities of the employe. If the owner possessed greater personality, was present on the ground, was a person to whom the employe could listen, could appeal, if necessary, he would be able to appreciate his existence much more vividly. In considering, therefore, the relations that exist between capital and labor in connection with great corporations, particularly railroads, the first thing for the employe to do is to dismiss all prejudices, to remember that if he has grievances, so also has the owner, and that, in the generality of cases, the grievances of the latter are far more manifest, far more real, than those of the employe. No one in railway employ, not blinded by passion or deliberately shutting his eyes to the fact, but knows that employes of such corporations are fairly treated and honorably esteemed by the proprietors. If not fairly treated, the injury is not traceable to the owner. Moreover, the grievances that employes suffer are often more imaginary than real, and whenever real they arise, not from the acts of the owner, but from those he is compelled to trust. The remedy does not, therefore, lie in strikes or indiscriminate attacks upon the property, but in representing to the owner of the property the nature of the wrong. Too great care cannot be exercised by the employes of corporations not to confound owners with others. The owner *will never*, it is safe to say, wilfully or persistently disregard the welfare of his employes; their interests are so

inalienably connected, that to treat the employe unfairly is to invite his own destruction. This truth is not always regarded by employes, and it is probable that the proprietor is in some sense responsible. Whenever this is so it is to be regretted. No one who is dependent upon the goodwill and fidelity of others for the maintenance of his interests can afford to shun their acquaintance or permit them to remain in ignorance of his good intentions towards them. On the contrary, his duty and interest alike demand that he should cultivate such relations with them as may be necessary to assure them of his constant and friendly regard and the beneficence of his purpose. *When it is necessary that men should entrust the immediate and general management of their property to others they must do so unqualifiedly and heartily, but such delegation of power should never extend so far as to relinquish the right and duty of enquiry into the welfare of subordinate employes. The proprietor will ever consult his welfare by such manifestation of interest in his servants, and any general or prolonged neglect upon his part to fulfill this cardinal duty of ownership will redound to his great and permanent injury. By many owners such manifestation of interest is thought to be subversive of discipline and it is possible that they have been encouraged in this monstrous delusion. It is a sufficient answer to say that where the owner of a railroad cannot come in contact with his employes without jeopardizing the discipline of the organization it ought not to require an outbreak among his servants, or the destruction of his property to convince him that there was a radical defect somewhere in its method of administration. The discipline of an organization that is dependent upon terrorism, upon ostracising or sequestering the employe, upon separating him from the acquaintance or sympathy of the owner, is manifestly a gross perversion of responsible methods of government and wherever*

practised evinces mismanagement and may be accepted as evidence of discontent and insubordination and an outrageous disregard of the rights of owners by those who encourage or practice it. If the tendency of corporate history in the United States teaches one fact more clearly than another it is that the owners of such property will find it to their advantage to manifest immediate personal concern in its affairs and in the affairs of those who operate it, lest their personality be lost and their property alienated or its value seriously impaired. The possession of property presupposes the duty of guardianship, including a paternal interest in those who operate it, and its preservation to the owner will ultimately depend upon the general and wise exercise of this duty.

Continuing our consideration of the fixed expenses of railroads, it is manifest that the cost of keeping a property in repair will be less relatively in the case of a road not in operation than in the case of one actually engaged. Repairs necessary to the track could be carried on in the former case without interference by passing trains or the thousand and one diverting influences that attend their movement. The equipment, moreover, not being in actual use, could be maintained at a uniformly high standard, whereas, in the actual conduct of affairs, it is frequently impossible to make repairs and renewals when needed and at a time when the work can be done at the minimum of cost and maximum of effectiveness. These influences, it is apparent, would sensibly and favorably affect the cost of maintaining an idle property. Moreover, if the suspension were not general among railroads, it is quite likely that much of the equipment might be rented to roads actively employed, thus affording means for its maintenance

besides returning a handsome revenue to the owner with which to meet expenses in other directions.

The cost of insuring a property, it is manifest, would not be less on account of cessation of business, except in so far as such insurance covered property in transit. The practice in regard to insurance is not uniform upon railroads. In some cases it is the policy to insure the property generally; other companies restrict their insurance to particular and ascertained instances of special importance; others again, do not insure at all, preferring to assume the whole risk. I do not know that the circumstances that would be likely to attend a cessation of business would be such as to require that a company's policy in this respect, whatever it might be, should be changed: the risk incurred from the movement of trains and the conduct of business generally would, it is apparent, be much less than under normal conditions, while all damages arising from the acts of mobs would be made good by the government. So that as a matter of fact, it is probable that under the conditions we have named a company would not run so great a risk from fire as in ordinary cases. No two companies view the question of insurance from the same standpoint, and no fixed sum can, therefore, be stated as to the extent of a company's expenditures in this connection. After considerable observation of the effects of insurance and non-insurance by great corporations, I should not think a company justified in expending any large amount in this direction unless its surplus were well assured and abundant. The magnitude of its property renders it quite proper for it to assume a risk of this nature, and while exceptions may be made in particular cases it is manifest that no general insurance of railway property can be made without proving an excessive burden. I would say, therefore, that the

cost of insuring the property of a company, no matter what its policy, might safely be reduced 90 per cent. in the case of a road not actively employed. The remaining ten per cent. I construe to be a fixed charge.

One of the Fixed Expenses of a railroad is its taxes. The widest difference exists, however, in the method of application; in some cases it is based on real and personal property; in others upon gross earnings. Where the tax is based directly on the property the levy would be the same whether the road were being operated or not. It is possible indeed that a reduction might be allowed under such circumstances; certainly a very material reduction should be made, as it is manifest that property of this kind that is earning nothing is, constructively at least, worth nothing and ought not to be taxed; certainly not upon the same basis as a productive property. Practically, however, it is probable that only a small reduction would be made. Where taxes are based on earnings—as they are in many states—it is manifest that cessation of earnings means cessation of taxes, unless the stoppage were so prolonged as to suggest some other basis. We cannot attempt, therefore, in advance to accurately measure the extent of a company's obligations for taxes in the case of an idle property, but whatever it is, it is a fixed charge.

MAINTENANCE OF PHYSICAL STRUCTURE.

All the Fixed Expenses that we have noticed up to this point relate more particularly to maintenance of organization. The force forming this organization may, as we have shown, be utilized for other purposes, but this is its primary purpose.

We come next to the maintenance of physical structure ; the property itself. To the fixed expenses occasioned by deterioration from natural causes. Two methods are possible by which this cost may be approximately determined. The first is by a careful survey of the property concerned, in which survey all its peculiar features shall be carefully ascertained and considered. This method is, undoubtedly, the most valuable in individual instances, as it is based on exact data. But, unfortunately, we have no such data, nor would it be of special value as applied to railway property as a whole for the reason that the resemblance between different properties of this description is only general. The moment we attempt to compare them in detail we find the greatest diversity exists. A table exhibiting the cost of maintaining a particular road arrived at by actual survey, therefore, would be of no value applied to roads generally. The other method that suggests itself by which we may ascertain the amount of Fixed Expenses for Maintenance is based on the percentage that such expenses bear to the total cost of operating under normal conditions. This is the basis I have adopted, and while particular expenses will vary greatly according to the method of construction, the extent of traffic and nature of the climate, still it is approximately correct as regards the average railway property of the United States.

Climate is a prime factor in determining cost of maintenance. Properties located in a warm climate do not suffer from the same causes that properties differently situated do, but each in its place has peculiar and exceptional expenses. Thus the deterioration of wood in a hot climate is much greater than where the temperature is lower. This serves to offset the expenses of northern roads engendered by frost and snow.

The conditions most favorable to the preservation of material are a mild and dry climate, but the cost of renewals in such localities is, for reasons that will occur to the reader, usually greater than elsewhere. The advantages and disadvantages of different localities are, therefore, about equal.

More than anything else, the Fixed Expenses of a railroad are dependent upon the quality of the material used, the measure of intelligence evinced in locating and constructing the various structures, including the roadbed, and the skill and foresight exercised in protecting the property. The nature of the structure is especially important. As the stone-arched culvert is more durable than one of iron, so is the iron culvert more lasting than that of wood. But, in either case, the duration of the structure is dependent upon its strength and upon the care with which it is constructed. In the same way, the permanence and value of ballast is dependent upon its weight and quality and the care exercised in placing it.

The nature of a business, as already stated, has much to do with the relation that Fixed Expenses bear to traffic expenses. If, as intimated elsewhere, a traffic is such as to quickly wear out the equipment, rails, bridges, culverts, and roadbed, manifestly, the proportion that wear and tear bears to natural deterioration must be greater than in other cases. It is proper, therefore, to state that the accompanying conclusions are based upon the operations of railways having a tonnage amounting to one million six hundred thousand tons annually; where the climate is temperate, and properties are subject to such extremes of heat and cold as are to be found in the great lake region, and where the average rate

of wages and cost of material is probably the same as in that of railway systems generally.

RAILS.

In attempting to analyze and exhibit the Fixed Expenses of railroads, we may commence with the track, this being the source of the greatest single expense. And in order that we may consider the subject more minutely and intelligently we will subdivide the expenses under their natural heads.* And, first, in regard to the Fixed Expenses for *Rails*.

When not in use the deterioration suffered by rails arises wholly from rust. Other classes of material, as a rule, suffer a certain percentage of loss from fires arising from natural causes, and from acute injuries occasioned by the elements. But in this case oxidation is practically the sole enemy we have to contend with. The deterioration from this cause is much greater in some localities than in others. The damage, it is noticed, is infinitely greater near salt water than elsewhere. The ability of rails, therefore, to resist the effects of climate depends upon location. We have, unfortunately, no accurate data of any kind as to the percentage of deterioration from climatic causes. It is a question about which metallurgists and scientists have little that is definite to tell us. It is

*These heads and the relation they severally bear to each other may be stated as follows:

New rails (less value of old).....	\$ 16 13
Handling rails (i. e. laying the new and taking up the old).....	2 34
Ties.....	13 97
Handling Ties.....	5 18
Miscellaneous (general) repairs, Roadway and Track.....	62 38

\$100.00

generally understood, however, that steel is less able to resist oxidation than iron. The deterioration of metal from oxidation is not uniform, but proceeds with increased momentum as the cause of decay deepens and spreads, each new inroad affording an additional storehouse in which the destructive elements multiply and extend themselves. The increase in the destructive power of rust may be likened unto the cumulative malignancy of a cancer ; as it grows wider and deeper it destroys the fibre and absorbs the tissue of the body, increasing in intensity with what it feeds upon, until the object attacked is no longer able to withstand the slightest strain. Oxidation is obviated by the exclusion of dampness. This would not be necessary if the article could be preserved free from abrasion or contact with surrounding objects ; for while dampness is the propelling or primary cause of rust, it is not operative except in case of abrasion of the metal, or its contact with some particle of matter. Either of these precipitates vapor by rendering condensation of moisture possible, thus inducing oxidation. Wherever there is a scratch upon a piece of metal, or wherever a particle of dust (however invisible to the naked eye) adheres to it, there moisture collects and through its evaporation rust is engendered. An abrasion, or particle, affords a vantage ground for the retention of moisture ; from this vapor arises precipitating the conditions described. It is believed that rails in actual use suffer less from rust than those not in use. The friction of the wheel polishes the surface of the rail, while the vibration of passing trains prevents the retention of moisture. Professor Carhart in answering a question in regard to the destructive tendency of rust and the length of time that a rail would resist its effects says :— “It is well known that a polished iron or steel surface

“does not rust so soon as a rough surface when exposed to
“the same conditions. Rough lines and sharp points appear
“to serve as nuclei about which water condenses. Moist air
“when expanded suddenly precipitates its vapor as a cloud,
“if dust is present to furnish centres of condensation. Frost
“crystals form first along scratches on glass. So moisture ap-
“pears to condense more quickly and freely on a rough surface
“of iron than on a clean polished one. Rusting takes place
“only in the presence of moisture. A clean plate in dry air
“never rusts. Mixtures of explosive gases do not explode
“when the electric spark passes, unless vapor of water is present.
“When a metal surface is once covered with rust, the rusting
“proceeds much more rapidly than at first, because the rust is
“hygroscopic; moisture is taken up and conducted inward to-
“ward the metal; hydrated oxides of iron are thus formed, and
“fresh metal underneath is attacked because of the presence
“of moisture or of the hydrated oxides on the outside. A
“coat of iron rust hastens the rusting process except when
“the metal is coated with the black oxide of iron. It can then
“be exposed to any weather without rusting. But the black
“oxide is formed only at a high temperature. The scales that
“fall from the rails as they come from the rolls are largely
“black oxide of iron.” In a climate such as we are treating
of, it is probable that fifty years of exposure would render a
rail unsafe for use. If this is so, the deterioration from natu-
ral causes is two per cent. annually. With a traffic such as
we have stated, the average period of usefulness of a rail is
14½ years. It is probable (for the reasons we have al-
ready specified) that a rail would last longer under very mild
usage than if not used at all, if its strength were commensu-
rate with the traffic. Under ordinary usage, the active and

rapid deterioration of rails is occasioned mainly by the speed of trains. Speed not only intensifies the friction, but increases the weight through its centrifugal force. Enquiries in regard to the percentage of decay of rails from natural causes elicits the most extraordinary difference of opinion. In some cases the whole percentage is ascribed to traffic. The highest rate ascribed by any one as a Fixed Expense was fifty per cent. In considering the deterioration of rails from natural causes, the damage would not, as already stated, be the same relatively for railroads doing a great business that it would in the case of those having a small business. Where a rail is worn out quickly, it is probable that the relative deterioration from rust is not nearly so great, though it is undoubtedly weakened from this cause, especially where defects of any kind afford a receptacle for moisture. Herein, undoubtedly, lies the secret of the sudden and inexplicable destruction of many rails that, according to the law of averages, should last many years. Just what the difference of deterioration from climatic causes between a rail in use and a rail not in use, is not known. Enquiries in regard to the Fixed Expense for rails, separate from traffic expenses, exhibit the greatest difference of opinion and diversity of view. One writer says: "I do not know how long rails would be effective for fast running trains if laid down and not used, but will allow a hundred years; and track that is used would last about ten years, hence, ninety per cent. of wear and tear." Another writer says: "The expense of maintaining rails is almost exclusively dependent on the traffic. If entirely idle, the loss by rust would be considerable in rails by weakening the fibre of the metal, and causing rapid wear and breakage when again brought in use. Under ordinary conditions, ninety-

"five per cent. is due to traffic." Another writer says: "There would be a slow destruction of rails from rust, which might take off 3 or 4 per cent. of the expense chargeable to traffic." Another writer says: "If no trains were run there would be no wear of rails, except such as might be incident to the action of the elements. A rail laid in track 24 years would deteriorate from rust to such an extent as to necessitate renewal in order to put the track in first-class condition."

Another authority writing upon the subject says: "The average life of the sixty-four rails we are studying, on the supposition that they are worn out when they have lost eight pounds per yard, and that the yearly tonnage is eight million tons, is thirteen years. If we are able to obtain steel rails as good in quality as the thirty-two slower wearing rails (the conclusions are based on sixty-four rails) this average life would be almost twenty years." The report of a meeting of road masters held in 1884 states that "The average life of a steel rail may be taken at nine years." The source of information is not stated, but the value of the rail, it will be noticed, is very much less than is generally given and is too small except upon roads doing an unusually heavy business. From numerous enquiries extending over a large area of country, and addressed to intelligent practical men actively engaged in the care and maintenance of track, they estimate the average deterioration from natural causes in wet and moist climate (such as is immediately contiguous to the great lakes) at about seven and a half per cent. At other, or interior points the deterioration is much less; probably not exceeding two per cent. From an examination of iron thus located that had been in nominal use thirty-three years, the *quality* of the metal had suffered no apparent deterioration. The loss from

oxidation could not accurately be ascertained, apart from the wear and tear of traffic, but it did not exceed two per cent. Professor Carhart says in regard to this specimen: "The roughness of the surface indicates that some inroads have been made upon its integrity. The fracture recently made reveals a highly fibrous texture of the iron. I do not detect much evidence of granular or crystalline structure. The iron left, therefore, is in good physical, or perhaps molecular, condition to do service."

Next in order, in connection with the Fixed Expenses of the track of a railroad, we may consider the important item of

CROSS-TIES.

The expenses connected with this item are exceptional. Probably no class of material used by railroads, save the natural ballast, suffers so greatly from the action of the elements. No matter how favorably placed, as regards the quality of the ballast in which they are imbedded, the deterioration is noticeable and rapid. The quality of the ballast, and the kind of wood of which the tie is composed, influence perceptibly its duration and usefulness. Ballast serves several useful purposes; however, aside from serving as a filter to protect the tie from water, it increases its bearing surface, strengthens the roadbed and increases its elasticity, and renders it more uniform. Undoubtedly, broken stone or slag are the kinds of material most useful for preventing decay or deterioration of the tie from the weight of passing trains. Next in order come cinders, gravel and sand, and finally common soil and clay. The expense of handling ties (i. e., replacing) is much

greater where slag or broken stone is used, on account of the difficulty of removal, including labor of readjusting the ballast. This is a disadvantage, and a very serious one, connected with the use of such material. It is, however, more than compensated by its great advantages. Where common soil or clay is used, the interior of the tie rots before it is otherwise injured by the traffic. Where the traffic of a line is heavy, the tie receives material harm from the respiking and resetting of rails, and where made of inferior wood, is frequently cut down and split by battered rails. A tie, if properly ballasted, receives little detriment from the wear and tear of light traffic, except when located on a curve, where it is subjected to much greater strain than elsewhere. This is also true of other portions of the track. The average duration of a tie being dependent upon the kind of wood of which it is composed, this factor becomes of prime consideration, but as this, in turn, is moderated by the nature of the climate and quality of the ballast used, all these varied conditions must be considered in arriving at a result. Probably the most serviceable tie that we have for all conditions of climate, ballast and use, is made of white oak. It is not only able to sustain a greater load, but affords very satisfactory resistance to the elements. The enquiries I have made of practical men in reference to the duration and value of ties, while exceedingly interesting, are not altogether satisfactory, for the reason that the premises upon which they base their conclusions are nowhere the same. This difficulty, however, besets the student at every turn in attempting to arrive at general conclusions from isolated instances. One writer, in attempting to define the duration of a tie, says: "It lasts about seven years. Without traffic, it would probably last ten years.

"Cedar ties would not last as long with traffic as oak, but "without traffic would last longer. The life of a hemlock tie "would not be as long as the above, with or without traffic." "Thirty per cent. should be charged to traffic account for "damage by rails cutting into the tie and injury arising from "driving and pulling of spikes, rendered necessary in changing "rails and re-gauging the track." The widest difference of opinion exists in regard to the durability of ties under different conditions. Thus, one writer thinks that "a tie will last "just as long in a track that is operated as it will in a track "that is not operated." Another writer of unusual intelligence says: "Natural decay of ties ballasted with the best "material, such as broken stone, gravel or cinders, would be "much less than where poor ballast was used. I should think "twenty-five per cent. less, as a tie would lay perfectly undisturbed and dry, and would not be cut into by the rail. In "poor ballast, such as soil and clay, the middle of the tie would "decay before its surface was damaged." The relative deterioration of ties from natural causes and from wear and tear is dependent upon so many contingencies that the most careful estimates for particular properties would not apply generally. However, it is probable that the fixed expenses of maintenance for ties under the conditions of tonnage and climate, such as we are dealing with, cannot be very far from seventy per cent., leaving thirty per cent. as chargeable to the wear and tear of traffic. There is the greatest difference of opinion among practical men as to the damage arising from decay and wear and tear, respectively, one writer insisting that no portion whatever of the cost of maintenance should be charged to traffic, while another not only insists that the tie is injured

from the weight of passing trains and the changing of spikes, but that "the movement of passing trains loosens the soil enveloping the tie, thus greatly hastening its decay."

The great cost to a railway company of its ties, and the increasing difficulty there is in procuring those of a suitable nature, will, in time, render it necessary to adopt every precautionary measure possible in order to prevent their decay. Heretofore, the first cost has been so light as not to warrant this added expense, or, if warranted, the resources of railroads have not generally rendered it possible. But, with the increased cost of ties and the difficulty of their procurement, scientific measures will be adopted to prevent destruction. It is not improbable that metal, perhaps papier mache, ties will ultimately supplant all others. Anything that prolongs the life of a tie or that is a substitute for wood, will be desirable from many points of view.

TRACK LABOR.

As labor enters into all estimates of track maintenance it is well, perhaps, before pursuing our enquiry further to note the relation that the different classes of labor connected with roadway and track bear to each other and to other expenditures. The data, it may be proper to say, is based upon compilations covering a period of years, over railroads aggregating twenty-four hundred miles of track and covering expenditures of ten millions of dollars for track labor proper, and twenty-one millions of dollars for rails, ties, roadway and track. It is as follows :—

Relation that the cost of various classes of track labor bear to each other.

Labor, Handling Rails.....	4.12	per cent.
Labor, Handling Ties.....	9.11	"
Labor, Ballasting.....	13.25	"
Labor, Ditching.....	6.11	"
Labor, Freshet Repairs.....	1.32	"
Labor, Watching Track.....	1.59	"
Labor, Clearing Track of Snow and Ice.....	6.82	"
Labor, Clearing Track of Weeds and Grass.....	6.42	"
Labor, General Repairs to Track, (including cutting rails).....	51.26	"
	<hr/>	
	100.00	

TRACK EXPENSES.

The Relation that the various classes of track expenses bear to total track expenses may be stated as follows :—

Labor, Handling Rails.....	2.34	per cent.
Labor, Handling Ties.....	5.18	"
Labor, Ballasting.....	7.54	"
Labor, Ditching.....	3.47	"
Labor, Freshet Repairs.....	.75	"
Labor, Watching Track.....	.90	"
Labor, Clearing Track of Snow and Ice.....	3.88	"
Labor, Clearing Track of Weeds and Grass.....	3.65	"
Labor, General Repairs of Track, including cutting of rails.....	29.16	"
Rails, Ties, Miscellaneous Track Material & Tools	43.13	"
	<hr/>	
	100.00	

Pursuing our enquiries in regard to Fixed Expenses we next come to the question of

GENERAL REPAIRS OF ROADWAY AND TRACK.

(NOTE. It will be observed that I follow the order and method of the classification of operating expenses devised by the railroad commissioners at Saratoga, June 10th, 1879.)

This account embraces all classes of material used in connection with the track, including tools and supplies used by trackmen, save rails and ties. It is probable that the material

embodied in this account is much more quickly and vitally affected by wear and tear than either rails or ties. Bolts, spikes, splice-bars, and nuts, receive marked and rapid deterioration from both climate and traffic, while the tools used by trackmen (and they comprise a considerable list) are quickly consumed. They are, however, merely incidental to the maintenance of roadway and track. General repairs of roadway and track embraces all classes of miscellaneous material and includes the cost of surfacing the track, ditching, freshet repairs, track watchmen, ballasting, clearing track of snow, and removing weeds, brush, and grass. An examination of these various classes of expense elicits the fact that a large proportion of them is directly chargeable to traffic. In the first place, the traffic of a line greatly impedes track laborers in their work. The necessity of repairs being made at a particular time, without reference to weather or accommodation of business, adds greatly to the cost. Not only are the men continually interrupted by passing trains, as every traveler has remarked, but the added expense on this account is much greater than those not familiar with the work would suppose. The necessity of keeping the track in condition at all times adds greatly to the expense. This necessity awaits on neither convenience or economy. An occasion arises and it must be met, no matter how great the waste it involves. All other classes of renewals await opportunity, but the maintenance of track (including bridges and culverts) in a shape to do business can never in a single instance be ignored or delayed. This fact and its significance is startling even to railway men. It follows from this urgency that in cases of unexpected mishap or accident that the work is frequently carried on at a great disadvantage, involving a large expense over what would be

necessary if the work could be pursued with reference to the economical use of labor and the procurement and choice of material.

The most surprising diversity of opinion exists among trackmen as to the proportion chargeable to Fixed Expenses for general repairs of roadway and track. This diversity of opinion is due in part to the peculiar and confusing circumstances that attend such expenditures. It arises also in part from differences in relative cost in different localities. The superintendent or roadmaster whose track is carefully and abundantly ballasted with broken stone or slag, if asked as to the cost of its maintenance, or the relative wear and tear of ties, or the duration of the ballast, will return an answer entirely different from that of the official whose road is ballasted with sand or clay. The effect of this local coloring, this restricted environment, this provincialism, is, as I have stated already, one of the most difficult things to overcome in any attempt to arrive at general conclusions about railroads. People speak of things, not as they are commonly, but as they see them from day to day. No one is superior to influences of this nature, and but few, even among the most thoughtful, can rise wholly above them.

As already stated the relation that Fixed Expenses bear to traffic expenses is governed largely by the amount of business. Wear and tear increases with increased use, (with the enlargement of business), but Fixed Expenses, (arising from decay), are not materially increased on this account, except in the case of rolling stock. I do not wish to be understood, however, as saying that while wear and tear increases with the increase of business, that the cost of repairing such injuries increases in like ratio. On the contrary it is cheaper to

maintain a track with the maximum amount of business than with the minimum amount, for the reason that it permits concentration of work within narrower limits.

In some cases, as we have shown, deterioration of property is largely due to traffic; in other cases it arises almost wholly from natural causes. The gradations from these wide extremes are infinite in detail and complexity. Happily, however, we are not beset in our inquiries by these difficulties in assigning the cost of ditching, freshet repairs, and removing snow, weeds, brush, and grass. The movement of traffic has but little to do with the filling up of ditches, and nothing whatever to do with the action of the elements, or the growth of vegetation. The movement of trains does not uniformly affect the cost of ditching and removing snow, weeds, brush, and grass; in some cases it increases the cost, in other cases the work is assisted thereby. The cost of repairing damages by freshets is greatly magnified by the movement of trains because of the urgency of the work and the inconvenience attending it. The expense of keeping a track free from snow and ice under normal conditions is lessened by the movement of trains; they assist to keep the track free from snow. Except for such fortuitous help cuts would become filled with snow and through the alternation of heat and cold this snow or its lower stratas would quickly turn to ice, rendering its removal both expensive and tedious. The movement of trains with the cursory assistance of trackmen keeps these cuts open. Were it not for this it would be necessary to run engines over a road at frequent intervals for the express purpose of keeping the track open. No portion, therefore, of the cost of keeping a road free from snow and ice is chargeable as a fixed expense; or at best only a small percentage of the amount belongs to

this account. In the event a road was closed indefinitely, it would matter little whether it was imbedded in ice or snow, and no expense of any kind would be required to keep it free from impediments of this kind, but in all ordinary cases the accumulation of snow would have to be prevented. In such cases the movement of regular trains from day to day proves a source of saving. It is also probable that the operations of business render it less expensive to keep a track free from weeds, brush, and grass. Except for the continual passage of trains and track forces these obstructions would quickly prevent the movement of business.*

Another important item of track expense is the cost of watchmen. This is chargeable to traffic, for, while they discharge an important and necessary duty, they would not be necessary except for the constant passage of trains.

In the enquiries I have had occasion to make in regard to the expenses connected with the maintenance of track, the marked intelligence of those in charge of work of this kind, and the purely speculative knowledge they have evinced in connection with it, has been apparent. Thus, in connection with the expenses connected with snow, one writer says: "To keep an idle road in condition so that business might be done at any time, would require that a snow-plow should be

* I remember going over a piece of road in the eastern part of Dakota in 1874 that had been abandoned for several months. The train consisted of an engine and two cars and three days were required in traveling eighty miles. The weeds and grass were from six inches to six feet in height. Everywhere the roadbed was tunneled with the burrows of jack rabbits and ground squirrels. The weeds and grass rendered the track so slippery that it was necessary for laborers to place sand and gravel on the rails as we proceeded. Water was procured with the aid of syphons from ponds along the road, and the trestles and bridges swayed under the weight of the train like telegraph poles in a tempest. When eventually this particular piece of track was opened for business it was found necessary to rebuild it entirely although the abandonment had only extended over a period of five years.

"used. The clearing off of snow also causes the track to "heave, and makes 'shimming' necessary." Another writer says: "A road would not be in first-class shape (if temporarily closed to business) buried under six feet of snow, and "yet the snow could not be kept off at ordinary expense unless there was a regular train service." Another roadmaster says: "Climatic cause is the largest source of expense, as we "should have to keep the track free from snow by special "means in the absence of regular trains. In reference to ballast, a considerable portion of the cost arises from the action "of the weather and wearing out of the ballast."

While there is no great divergence of opinion in regard to the nature of deterioration, there seems to be the greatest diversity of opinion among practical men as to the proportion chargeable to Fixed Expenses and traffic, respectively. The question is a new one; with more reflection, it is probable they will be able to harmonize most of their differences. Men experience difficulty in forming an opinion as to the relation Fixed Expenses bear to traffic expenses, on account of the primary fact that the whole is immediately due to traffic. This is true in the sense (as I have already explained elsewhere) that every expense or outlay to which a company may be subject is due to business. Traffic must take every such outlay. But, in an enquiry that seeks simply to determine what the local exigencies of a property are, what proportion of its expenses is due to wear and tear of business, and what expenses arise from natural causes, I think we may attempt a separation of expenses without harm or fear of being misunderstood. Every expense must, of course, be borne by the revenue of a property, but that fact does not make the ascertainment of the source of the expense any less interesting or less

valuable to its possessor. But the confounding of forms with general principles, I observe, occasions more or less confusion in the minds of enquirers and renders them liable to decide every question according to preconceived notions. It is partly in consequence of this, no doubt, that in some instances those especially familiar with the operations of track, ascribe an enormous preponderance of expense to traffic, while, on the other hand, men of corresponding intelligence ascribe it to natural decay. Where divergencies so wide exist, no man can presume to determine the true mean. In attempting to arrive at an approximate statement of the truth, the testimony of all extremists of this kind, it is apparent, must be eliminated. After throwing out evidence of this character, I find that the differences of opinion among practical men in reference to Fixed expenses are not great. According to their estimates (and they number a hundred or more), I find that fifty-seven per cent. of the expenses of roadway and track is considered to be a Fixed Expense, and that forty-three per cent. is due to traffic. In other words, if a railroad were to cease to do business, it would only reduce its expenses for miscellaneous track material and tools and general roadway and track labor forty-three per cent., unless the suspension were permanent, or likely to extend over a period of a year or more. Fifty-seven per cent. would be required to maintain the track in a condition to resume business. This is the careful and considerate judgment of practical men. I have thought that the investigation would have been rendered somewhat more clear if I could have known the expense for track tools separately from miscellaneous track material, but with this knowledge we should still be unable to determine what proportion of the deterioration of tools was due to fixed and traffic expenses, re-

spectively. Another obstacle experienced in a separation of expenses is the difficulty of determining the proportion of the expense of ballasting, surfacing, tamping, etc., due to the weight and vibration of moving trains separately from the damage occasioned by natural causes. These insurmountable obstacles make it apparent that anything like an accurate ascertainment of relative expenses arising from decay and traffic, respectively, is impossible, so far as the track is concerned. It is probable, however, that the estimate given above approximates very nearly the correct figures.*

GREAT IMPORTANCE OF ACCURATE TRACK ACCOUNTS—VALUE OF DEFINITE KNOWLEDGE TO RAILWAY OPERATIVES.

Enquiry among practical men elicits the fact that the question of Fixed versus Traffic expenses has received little or no attention. The subject, is however, of great interest and has excited many enquiries in regard to the nature and result of my investigations. The fact has induced me to pursue my enquiries much further than I originally intended. The subject, in its entirety, seems to have received little or no attention and many of those with whose views I have been favored—and to whom I am greatly indebted—have, I find, changed their opinions most radically after thoughtful reflection in regard to the different phases of the subject. Thus, one very intelligent gentleman stated that the whole cost of

* From statistical compilations extending over a long period of time, it appears that expenses of track and roadway bear the following proportion to the total cost of operating railroads, including taxes, viz.:

Rails.....	3.28 per cent.
Ties.....	3.40 "
General repairs of roadway and track.....	11.09 "

repairs of fences was a fixed expense, i. e., that the whole cost of maintenance grew out of the decay of the material of which the fences were constructed. Another official, however, corrected this mistake by pointing out that a certain proportion of the expense of maintenance was due to fires caused by passing locomotives. This was undoubtedly the case and was quickly admitted by the first named gentleman when the matter was again referred to him. I merely cite this instance as evincing a lack of thought by practical men in regard to the relation of cause and effect in the maintenance of railway property. The relative expenses incurred by railroads for various purposes are frequently as surprising to railway men as to others ; this, of course, arises from lack of definite information. Indeed, in many cases, information necessary to throw light upon an important subject is not obtainable, and its want not even suspected, perhaps, by those whose duty it is to supply it. The acquisition of necessary and valuable data upon which to base conclusions of this nature involves, in the majority of instances, systematic and long continued enquiries requiring infinite patience and unselfish interest in apparent abstractions. This is especially true in regard to the collection of data required in forming general conclusions, nor is the habit as generally practiced as it should be in more practical matters. I think the absence of accurate and general data is more noticeable in connection with the repairs and renewals of railroads than in any other department of the service. Nowhere else does the absence of definite knowledge seem quite so apparent or startling. To illustrate, the enormous masses of track material and labor that the work involves, instead of being carefully ascertained and classified, we find grouped in a conglomerated mass. No subdivision of

labor is attempted in many cases, but the whole aggregated in one general charge to maintenance of roadway and track. The sin of omission and commission is aggravated by the fact that the force is largely engaged in miscellaneous work, involving construction, repairs of fences, road-crossings, signs, telegraph, bridges, culverts, and other duties. The lack of information as to how the track force is occupied arises, of course, from imperfect methods of accounting and from a belief in many cases that accurate data is not obtainable. This lack of definite information in regard to track affairs was first brought to my attention a quarter of a century ago by an enquiry made by a railway superintendent. Out of this enquiry grew a system of track accounts that was thought to be very elaborate at the time. In the case in question, the manager desired an explanation of the reason why there was a large increase in the pay-roll for a particular month. No accounts being kept of the division of labor, the only explanation obtainable was *that there was an increase in the force*. What the force was doing, was a matter of surmise. This led to investigation, and afterwards to the introduction of a very simple and concise method of distributing the time of trackmen. I remember very well that when the system had been perfected and the method was explained to the superintendent that he laughed, remarking ironically that "it would not do at all, as there was not a foreman on the road possessing the "clerical skill required to carry it out!" He agreed with me, however, that if there was a foreman that could not perform this labor he was not a fit person to entrust with so important an enterprise as the care and maintenance of the track of a railway. Accordingly, the new system went into effect. There was not only no complaint, but as the results were pub-

lished for local distribution they elicited the hearty interest of roadmasters, section men and managers. From the statistics thus compiled, the management were able to tell what it cost to handle rails and ties, the expense for keeping the track free from snow and ice, for ditching, ballasting, track watchmen, removing weeds, brush and grass, and freshet repairs. Moreover, the extent and cost of the labor performed by trackmen in other departments of the service was accurately noted and charged. Many gross mistakes and long-cherished delusions were dispelled by these statistics. One of the most surprising that I recollect was the apparently stupendous sum that it cost to remove a tie and lay one in its place. The percentage that particular kinds of labor bore to other kinds of labor was another source of surprise, and occasioned the introduction of many reforms not previously esteemed important. The accounts, moreover, exhibited the number of men, or fractional parts of men, employed on each mile of track occupied exclusively in track-work. This information was of great value to the management, as affording evidence of the relative economy exercised by roadmasters and section foremen. The information excited, moreover, intense interest among trackmen, and was the occasion of the utmost strife as to who should make the most favorable exhibit.*

Thus, a system of track statistics of the greatest utility and value to its possessor grew up out of a cursory enquiry; a system which seemed impracticable appealed from the first to the intelligence and interest of all those having any interest in track affairs. The history of this system of track

*The System of Track Accounts referred to herein will be found illustrated and described in a pamphlet entitled "The Track Accounts of Railroads and How They Should be Kept."

statistics illustrates the growth and development of the railway system generally. I have been minute in its description because of its pertinence to the subject we are discussing and *because of the great importance to a railway company of a complete and perfect method of keeping track accounts*. Not only is it of importance that the relative expenses involved by different conditions should be known, but it is only in such a way that an accurate account can be kept of the time worked by the track force and that a necessary and proper check can be maintained over it by those who have such interest in charge. It is only by sub-dividing the labor so as to separate that which relates to track from that which relates to other or collateral interests that we can determine whether the force engaged is economically handled or not, and as this force involves a large percentage of the aggregate cost of operating a railroad its importance may be readily understood.

BRIDGES, CULVERTS, AND CATTLE GUARDS.

This account comes next in the order of our enquiry. It is apparent in connection with this important item of expenditure that the cost of maintenance, no matter from what source the damage arises, is, as it is in so many other cases in connection with railway property, dependent very largely on the nature of the structure and the quality of the material used in construction. Manifestly a wooden bridge decays much more rapidly than one of stone or iron or steel. The process of decay that is going on in such structures cannot be prevented. The surface may be protected but the heart of the material soon succumbs to the moisture of the surrounding

atmosphere. A large percentage of the expenses connected with wooden bridges may be said to arise from natural causes. These causes are, however, accelerated by the opening of the joints and fissures in the material, and the straining of the fibre of the wood generally by the weight of passing trains, thus exposing the inner portions to the action of water and frost and thereby hastening its decay. To the extent that this is so the damage is chargeable to traffic. The repairs and renewals occasioned by the wear and tear of traffic are, in the case of the majority of structures, proportionate to the business done. This truth finds illustration in the experience of every bridge builder. He quickly discovers that expenses for repairs where traffic is great are much larger than where traffic is small. This is so marked as to be a constant subject of notice in his experience and records. However, where a business is small greater care is possible in its discharge, enabling bridges to be used that would not answer at all where the traffic was more imperative and pushing; to whatever extent this prolongation of the life of a bridge extends it is a saving. Turning to iron and steel structures, their duration is not known, as the extent to which the strain upon the metal affects its fibre, thereby injuring its elasticity and strength, cannot be estimated in advance. The frightful accidents in the experience of railroads arising from the breaking down of iron and steel bridges that were apparently stable, renders it certain that the material of which they are composed suffers constant, and in many cases rapid, deterioration from usage and exposure. The damage arising from the first-named cause is, of course, chargeable to traffic.

The intimate relation that the bridge occupies to the road-bed and the difference in degree to which they respond

respectively to the action of frost renders their adjustment a source of constant expense and anxiety. Not only is the alignment of the track differently affected, but the track does not settle or rise uniformly. The jar and weight of trains also affects bridges and culverts so perceptibly as to continually require their readjustment. The expense of preventing the channel under or above these structures from becoming obstructed, and damages from freshets, constitute a Fixed Charge. Experts place the duration of usefulness of wooden bridges, under a light traffic, at eleven years. The life of an iron or steel structure is much longer, and to the extent that this is so the per centage chargeable as a Fixed Expense on this account is correspondingly less. But the expense of protecting the latter structures from climate is much greater than for wooden bridges, and in so far as this is so the Fixed Charge on this account is relatively greater. Iron and steel structures require to be painted at frequent intervals and their durability is further prolonged by protecting them from the direct action of rain and frost. In the case of stone-arched culverts where the material is of durable quality, properly laid, and of sufficient strength, the expense arising from natural decay is merely nominal. The average annual expense of repairs and renewals rendered necessary by the natural deterioration of bridges and culverts will depend, it is apparent, upon the nature of the structure, including its strength, and the volume of the traffic. Taking the railway system in its entirety, with its alternation of wood, iron, and stone structures, and a traffic such as forms the basis of our calculations, it is probable that the annual Fixed Expense is in the neighborhood of seventy-five per cent. My investigation in regard to these structures has extended over a considerable mileage of road and there

appears to be no great divergence of opinion in regard to the relative expense for maintenance and traffic. The percentage that I have given is that of experts and the average judgment of a large number of men familiar with all the practical aspects of the subject. Some of their communications are exceedingly interesting. Thus one writer says:—
“A bridge will lay still all summer, but as soon as winter sets in it is all out of shape. It heaves by frost up and down and sideways and out of line, causing it to be cut down, shimmed and respiked. Wooden bridges are very short lived, their life being ten or twelve years. Traffic affects them a little by shaking.” Another writer says:—“The relative expense depends upon whether the bridges are built of iron or wood; whether heavy or light structures if of wood. If light they will deteriorate more rapidly under moving trains because the timber will spring, disturbing the fibre and opening the grain for the admission of water, thereby causing decay.” Another writer says:—“I notice that the cost is much greater upon some lines than upon others. It is attributable to the difference in traffic. The bridges that we use where the traffic is light and that we derive good service from, would not answer at all where the business was great.”

The average annual Fixed Expense on account of these structures, these gentlemen so well qualified to judge place at seventy-five per cent. This percentage, while true of the conditions under which we write will, however, be reduced with every increase of traffic.

BUILDINGS.

The wear and tear of machinery, furniture, implements, and hardware used in and about buildings is almost wholly chargeable to traffic. The platforms, doors, windows, warehouses and depots are also greatly injured from this cause. The expenses attending the care and maintenance of buildings, it is apparent, are not uniform any more than in the case of other structures. The imperceptible wear and tear and the accidents and mishaps of business occasion more or less damage as may be readily supposed, but its extent is not uniform. The nature of the structure has much to do with its ability to resist deterioration from natural causes. But while brick or stone buildings require, relatively, little or no attention, the doors, windows, roof, floors, and other appurtenances of such structures, require constant attention, and the cost of maintenance in these respects at least is not in any sense materially different from that of other buildings. In addition to the ordinary wear and tear of buildings caused by traffic are the losses occurring by fires chargeable to this account. The cost of renewals and repairs rendered necessary by the wear and tear of traffic depends largely upon the nature and extent of the business. It is also true as stated that the ability of a structure to resist deterioration is dependent upon the material of which it is constructed, and the manner in which it is built, but the differences are not so great that we cannot determine with reasonable accuracy the proportion chargeable as a Fixed Expense for the buildings of railroads as a whole. From careful enquiries of experts in such matters and from other sources, this expense is found to be seventy per cent. of the annual charge.

FENCES, ROAD-CROSSINGS AND SIGNS.

Deterioration here, it is apparent, is largely attributable to natural causes. The damages arising from fires ignited by passing trains and slight injuries to road-crossings, are about the only expenses connected with this account chargeable to traffic. It is apparent, however, that the damage occasioned by fires is not nearly so great where wire is used for fences as where lumber is used; indeed, in the former case, it may be stated that the expense is merely nominal, while in the latter it is fully twenty-five per cent. As, however, the use of lumber is everywhere giving place to wire, our estimate may be placed upon the general use of the latter. Taking this as the basis, the proportion of this account chargeable as a Fixed Expense, may be placed at ninety-five per cent.

ROLLING STOCK.

This great source of expense to carriers is enormously increased by the outlay required to prevent deterioration from natural causes. The deterioration is much greater when the plant is actively employed and subject to all the vicissitudes of weather than if carefully housed and protected, as would be the case with a portion of it, at least if not in actual use. The extent of damage from natural decay is at all times largely dependent upon the protection afforded; if properly housed, the loss is much less than under other circumstances. While, however, facilities every day become more ample and better regulated, they do not yet generally contemplate placing passenger and freight cars under cover where they will be protected from

rain and snow when not in use. A writer, speaking of the cost of preserving machinery from deterioration when not in use, says: "A locomotive taken into the shop and covered, "with tallow, would be ready for service with very slight repair "to the stack and other parts. The atmosphere would have "a greater effect upon freight cars, and it would be necessary "to paint them at periods (probably of considerable length), "as they would suffer from dry-rot and other causes. "With regard to passenger cars on the same basis, the "percentage would not be so great as freight cars, as "the material and finish is better, but they would "require a coat of varnish, at long intervals, to preserve the "outside paint." The upholstery of passenger cars suffers constant deterioration whether in use or not, no matter how careful the attention. The wear and tear of equipment from traffic may be said to be proportionate to its use. This is, of course, measurably true of other accounts, but it is especially true of locomotives and cars. The cost of repairs and renewals may, moreover, be said to depend largely upon the intelligence and promptness with which they are made. If the locomotives are not properly painted, cleaned and housed, or if passenger cars are not kept cleaned, painted and varnished, or if freight cars are not painted at the proper time, and repaired as needed, the deterioration will multiply with the neglect. In all attempts to determine the percentage of deterioration I assume that due diligence and skill is exercised in the maintenance of the property. Upon this basis the minimum amount of damage that equipment suffers when not in use chargeable as a Fixed Expense amounts to :

For Locomotives.....	5 $\frac{2}{3}$	per cent.
For Passenger Cars.....	6 $\frac{2}{3}$	"
For Freight Cars.....	9	"

The deterioration from natural causes chargeable as a Fixed Expense when equipment is in use may be said to be as follows :

For Locomotives.....	8½ per cent.
For Passenger Cars	9 “
For Freight Cars.....	10 “

TELEGRAPH.

The Fixed Expenses of Telegraph, if we include fixtures required in connection with it, such as furniture, tools, machinery, batteries, instruments, and other appurtenances, is not far from ten per cent.

While it is apparent from the foregoing enquiries that innumerable differences of opinion will be found to exist among experts as to the amount of the Fixed Expenses and the relation they bear to traffic expenses, there is no difference of opinion whatever as to the fact that the cost of maintenance is never exactly alike in any two cases. It is ever dependent upon the location of the road, the volume of business, the speed of trains, and the manner in which the property is constructed. The most accurate data, therefore, in regard to a particular road would not be conclusive in regard to other properties. It will, however, afford a very fair average, for however greatly railways differ from each other in particular things there is a natural uniformity between them. If, therefore, accurate data were obtainable in regard to several well constructed and efficiently managed roads, this average would afford us a very fair glimpse of railway enterprises, gen-

erally. Fortunately we have this data, covering a period of twenty years, for railways embracing in all two thousand miles of road. From these it appears that the various items of operating bear the following relation to each other, viz. :

Maintenance of Track	43.76	per cent.
Maintenance of Bridges and Culverts	6.33	"
Maintenance of Buildings	9.03	"
Maintenance of Fences, Gates, and Crossings	1.95	"
Maintenance of Equipment	38.93	"
	<hr/>	
	100.00	per cent.

These expenses bear to the total expenses of railroads for the same period of time the following proportion :

Maintenance of Property	42.62	per cent.
Other Operating Expenses	57.38	" "
	<hr/>	
	100.00	per cent.

A table will be found appended hereto showing in detail what the fixed expenses amount to. The figures given embrace simply the skeleton of an organization and the expenses of maintenance rendered necessary by the elements and natural decay. Instead of attempting to exhibit the aggregate cost in dollars and cents, I have sought rather to show the relation that these expenses bear to the current cost of operating railroads, so that we have only to know what the total expenses of a railroad are in order to estimate its Fixed Expenses.

The accuracy of these figures will be questioned by many, and with very good reason, it is quite likely. The subject is so entirely new and the data so meagre, that, no matter what figures were used, they would very justly be the subject of criticism.

FIXED EXPENSES.

Percentage of the total cost of Operating that is due to Maintenance of Organization or that arises from Natural Decay of the property.

NAME OF ACCOUNT.	PERCENTAGE. (Fixed Charge.)	
Renewal of Rails.....	2	
Renewal of Ties.....	70	
Repairs of Roadway and Track.....	57	
Repairs of Bridges, Culverts and Cattle Guards.....	75	
Repairs of Buildings.....	70	
Repairs of Fences, Road Crossings and Signs.....	95	
Repairs of Locomotives.....	8½	In the case of a Rail- road not in operation } the expense would be {
Repairs of Passenger Cars.....	9	
Repairs of Freight Cars.....	10	
Telegraph Expenses (Maintenance).....	10	
Agents.....	50	In making these esti- mates, the wages of the force retained are reduced 50 per cent.
Clerks.....	25	
Train Force.....	12½	
Salaries General Officers and their Chief Clerks.....	50	
Law Expenses.....	50	
Oil, Waste and Tallow.....	1	
Stationery and Printing.....	1	
Contingencies (and Miscellaneous).....	1	
Insurance.....	10	
FIXED CHARGES OTHER THAN OPERATING.		
Taxes.....	100	Except where taxes are based on earnings or special reduc- tions can be secured.
Interest on Funded Debt.....	100	
Sinking Fund Requirements.....	100	
Leases, Contracts and Agreements.....	100	

On the foregoing basis it appears that the FIXED CHARGES of railroads approximate 20.90 per cent. of the total cost of operating, excluding taxes.

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